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Worldwide Report

TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

No. 179

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CONTENTS

WEATHER FORECASTING SYSTEM BEING MODERNIZED

Dacca THE BANGLADESH TIMES in English 14 Jul 81 pp 1, 8

[Text] The United Nations Development Programme (UNDP) has extended a programme to improve the flood and tidal wave forecasting in Bangladesh till 1982 according to an official source.

The Meteorological Department which has undertaken eight projects to modernise its weather forecasting system would greatly benefit from the programme designed to remove various obstacles now facing the department.

Meanwhile the UNDP has undertaken training of the weather experts in computer programming and data processing on weather forecasting.

Under another contract with UNDP the Meteorological Department has strengthened its weather services for the air services.

Total allocation for the department for 1980-81 was Taka 172.45 lakh but only Taka 43.91 lakh were spent till March 1981.

Some of the important programmes of the Department to improve the services are: Khepupara Radar station. So far Taka 82.20 lakh out of total allocation of Taka 90 lakh had been spent. The station, when completed, would provide coverage for the entire coastal areas of the country.

Development of communication services for weather forecasting: Plan to be implemented at a cost of Taka 149.66 crore, the programmes are designed to remove the present difficulties in relaying information on weather to the objectives.

Workshop and laboratory: About 90 percent work of establishing the project in Dacca for processing various date and maintenance of the centres have been completed. The programme is to cost Taka 118 lakh.

Weather station at Mohakhli, about 95 percent work of the project to be set up at a cost of Taka 66 lakh have been completed.

Beside these, work on construction of housing accomodation for the weatherman at Agargaon and a training centre is nearing completion.

The Meteorological Department planned to set up a weather observatory at Tangail while the construction of such observatory at Feni, Sitakund and Hatiya is at various stages of completion.

During past few years the Met Department has innovated a number of new programmes to keep the people conscious about weather and also provided them with important information about weather for agricultural activities.

One of them was warning for unusual rainfall. During 1977-78 the Department had provided 43 warning which increased to 77 in the following but reduced to 65 in 1979-80 and slightly increased in 1980-81.

The major services were rendered to the air services which were given 8660 weather forecast while the shipping services were properly fed.

CSO: 5500/7166

BRIEFS

TELEGRAPH, TELEPHONE BOARD--The Bangladesh Telegraph and Telephone Board would instal 340 more coin-box telephones throughout the country during the current year. It is gathered that to date the T&T Board has already installed 160 coin box telephones at various places. During last year (1980-81), the T&T Board had commissioned the following automatic exchanges: Ramna (Dacca) Central Exchange: 10,000 lines; Sher-e-Bangla Nagar additional exchange: 3000 lines; Jessore additional exchange: 600 lines; Narshingdi additional exchange: 400 lines; Sagarika (Chittagong) exchange: 600 lines; and Kurigram (Rangpur) exchange: 400 lines. The following connections under the T&T Board's High Frequency Microwave project have been established: (a) Bogra-Shantahar-Natore-Rajshahi; (b) Kushtia-Chuadanga; (c) Phulbari-Dinajpur-Thakurgaon. Other development projects of the T&T Board completed during the last fiscal year also include the 14 base stations commissioned under the "radio PCO in rural areas." Of the existing 170 PCO's 47 had been commissioned during the last fiscal year (1980-81). [Text] [Dacca THE BANGLADESH TIMES in English 17 Jul 81 pp 1, 8]

CSO: 5500/7167

TELECOM EXPANSION PLAN FOR BALUCHISTAN

Karachi DAWN in English 10 Aug 81 p 5

[Text]

QUETTA, Aug 9: A comprehensive programme to expand telecommunication facilities is being implemented in Baluchistan during the current financial year to link farflung areas of the province with the telephone network. The plan also envisages extension of Quetta Central Telephone Exchange.

This was stated by the General Manager, Western Tele-communication Region, Mr Fatahul Azam, at a news conference in Quetta yesterday.

He said over Rs 83 million were spent for this purpose during the last financial year. Giving details of the expansion programme, he said the telephone capacity of the region is being expanded from 6000 to 10,000. The installed capacity of Quetta Central Exchange will be increased to 8000 lines by 1982. He said during the current year 1000 lines will be added to this exchange to provide still better facilities for the people in the provincial capital.

AUTOMATIC EXCHANGES

About the expansion of telecommunication facilities in the interior of the province, he said automatic exchanges are planned for Usta Mohammad Pishin, Zhob, Kharan, Turbat Gwadar and Mastung.

He said the department plans to open more PCOS in different parts of the province every year. A plan for opening 75 PCOS in next three years is also being processed for implementation.

Mr Fatahul Azam said a new high capacity microwave system has recently been approved to link Karachi through Hub, Bela, Khuzdar Kalat, Quetta, Muslim Bagh, Loralai and Dera Ghazi Khan. Karachi is also proposed to be linked with Omara, Pasni, Gwadar and Jewni with spur with Turbat.

He said a 200-lines exchange with NWD trunk dialling facilities is under installation at Uthal and will be completed within next three months replacing the present hundred lines mini exchange.

Simflarly 100-lines exchange has been set up at Hub and old exchanges at Bela and Gaddani are being replaced with new high capacity exchanges to provide dependable telecommunication services in Lasbela district. About Rs one million have been earmarked further modernising telecommunication services for Gaddani.

He said a multi-channel ultra high frequency system is under installation linking Karachi, Hub and Uthal replacing the existing overhead line with a reliable system.

The General Manager said the areas like Kohlu Agency, Chagai district and Mekran division had been given special attention for the development of telecommunication facility. He said places like Turbat, Ormara, Pasni, Gwadar, Panjgoor, and Jewni have been brought on better and more reliable trunk net work.

In northern areas of the province new line has been provided from Loralai to Zhob via Murghakihzai, Sinjavi and Ziarat and existaing line between Sibi and Loralai is being further strengthened and modernised.

NEW TRUNK LINES

Moreover new trunk lines have been erected including Bela, Turbat via Awaran, and Khuzdar-Turbat via Awaran in order to provide reliable alternate routes from divisional headquarters at Turbat and provincial capital at Quetta.

He said a new high capacity microwave system between Quetta and Sukkur has recently been commissioned facilitating normal operation of telephone, telegraph and TV channels.

Giving facts and figures, the General Manager said the working of telecommunication system in this region was satisfactory and the numbers of complaints like excess billing, faults in telephones circuits etc were lowest in the country.

He said efforts were being made to further improve the telecommunication service within our limited resources.

The Director T and T, Syed Mehmood Ahmed, who was also present at the new conference said that a little over 1500 applications for telephone connections in Quetta were pending with the department. He hoped that the number will be considerably reduced with the addition of new telephone lines to the Quetta Exchange within next three months.—APP

CSO: 5500/4590

RURAL PHONE EXCHANGE OPENS

Manila BULLETIN TODAY in English 10 Aug 81 p 9

[Text] The Philippine Long Distance Telephone Co. (PLDT) has opened a telephone exchange in Tanjay, Negros Oriental, under the company's ₱110-million, ten-year rural telecommunications development program.

The second one of its kind to be installed in the Visayan region, the telephone exchange is equipped with the cross-bar type automatic switching system. Tanjay's phone exchange has an initial load of 100 lines and has a maximum capacity of 200 lines to meet the town's growing requirements.

Ramon Cojuangco, PLDT president and chief executive offer, said the company's rural telecommunications development program is in response to government's call for the private sector to contribute to the development of new growth centers in the countryside.

Jose P. Dans, Jr., minister of transport and communication, said PLDT's rural telecommunications development program is part of the company's effort to hasten the expansion of communication services throughout the country.

This is in line with the program of the government, as directed by President Marcos, to provide the whole country with the vital infrastructure of development, he said.

"Aside from its program in the rural areas, PLDT is also implementing a nationwide service improvement, expansion and modernization program," he said.

Like other PLDT rural telephone exchanges the Tanjay exchange is linked not only with PLDT's nationwide system but to all countries in the world reached by the company's overseas telephone service.

CSO: 5500/4903

THU DUC BUILDS WIRED RADIO STATION

Ho Chi Minh City TIN SANG in Vietnamese 13 May 81 p 7

[Article: "Our City: Thu Duc Strengthens Cultural Acitvities"]

[Text] Builds Wired-Radio Station--In the morning of 9 May 81, at the Thu Duc Cultural Center the district people's committee held a meeting to discuss plans for building a district wired-radio station including: Step I, build a transmitting station in the district; step II, perfect the receiving and transmitting systems in the villages, and at the same time get the machinery and personnel ready so as to be able to begin drawing up plans for building the station toward the end of May 1981.

With a view to expanding the transmitting network to timely serve the peasants during the summer-autumn season, the Thu Duc cultural and information branch has controlled and repaired the lines of the transmitting stations in the villages of Hiep Binh, Tang Nhon Phu, Binh Trung, Thanh My Loi, An Phu, and the Workers' Quarters. The transmitting network in Hiep Binh and Tang Nhon Phu villages has been expanded to the hamlets and production collectives. In Hiep Binh, construction of four broadcasting stations in four hamlets has been completed.

9213
CSO: 5500/4558

HANOI-HAIPHONG TELEPHONE LINE INAUGURATED

Hanoi QUAN DOI NHAN DAN in Vietnamese 1 Jul 81 p 1

[Article: "Coaxial Cable Telephone Communications Line Inaugurated Between Hanoi and Haiphong"]

[Text] VNA--In the morning of 30 June in Hanoi, the Posts and Telegraph branch held an inauguration ceremony to mark the completion of a 110-kilometer-long coaxial cable telephone communications line between Hanoi and Haiphong.

Pham Nien, head of the Posts and Telegraph General Department; Michel Combal, ambassador of the Republic of France in our country; and representatives of the French Communications Firm CIT-ALCATEL attended the ceremony.

This is a modern communications system over coaxial cable consisting of two conducting lines which surround a central conductor, capable of transmitting simultaneously 360 telephone calls.

After 6 months of design and building with the assistance of French technicians, the posts and telegraph units of Hanoi, Hai Hung and Haiphong have completed the work according to plan and put it into use before the rain-and-storm season.

9213
CSO: 5500.4587

BRIEFS

GULF COUNTRIES COMMUNICATIONS PROJECT--Abu Dhabi, 23 Aug (ENA)--The representatives of four Arab Gulf countries--the UAE, Saudi Arabia, Qatar and Bahrain--will meet in Abu Dhabi on Tuesday to discuss linking the four countries with a coaxial cable to enhance direction communications among them. 'Ali al-'Uways, director general of the UAE communications authority (Al-Amirtel), said the 1-day meeting will be devoted to discussing the coaxial cable, which will cost about 50 million dirhams. He said the project will strengthen direction communciations with some countries in the area and will increase the efficiency of several departments in the UAE and elsewhere. [Text] [GF240522 Abu Dhabi EMIRATES NEWS AGENCY in Arabic 1817 GMT 23 Aug 81]

CSO: 5500/4727

BRIEFS

NEW SATELLITE LINK--Kuwait, 18 Aug (KUNA)--The communication department of the KUWAIT NEWS AGENCY (KUNA) announced today it has developed a new system that will enable the agency's bureaus and subscribers in different countries to receive its news service simultaneously. KUNA satellite lines have been hooked to a distributor to enable all receiving points to receive the transmission at the same time, communication chief Hassan al-Khabbaz said. Al-Khabbaz cited the example of Bahrain, Vienna and London where subscribers to both the Arabic and English services are already receiving KUNA transmissions at the same time. [Text] [GF191221 Kuwait ARAB TIMES in English 19 Aug 81 p 6]

CSO: 5500/4727

POSTAL, TELECOMMUNICATIONS UNION ENDS MEETING IN LOME

Lome LA NOUVELLE MARCHE in French 31 Jul 81 pp 1, 4

[Text] Beginning on Tuesday, the sixth regular session of the Council of Ministers of the African Postal and Telecommunications Union (APTU) came to a close yesterday afternoon at the RPT [Rally of the Togolese People] headquarters in Lome.

The final communique issued at the end of the session and which was read by Mamadou Simpore, secretary general of the APTU, reveals important decisions, including: the establishment of an African Savings Bank Institute to serve as a center of research, training, cooperation and protection of savers and whose main office will be in Cotonou in the People's Republic of Benin; the adoption of a vast program of training, cooperation and assistance in the area of the organization of services; the adoption of a common action plan to help Chad; the adoption of a recommendation to vigorously protest South Africa's membership in the UPU [expansion unknown]; provisions relative to payment of postal orders and transfers; a proposed study of the telecommunications rates system for the APTU; the establishment of a repair and recalibration shop for scales, whose headquarters will be in Lome; the continuation of the study on possibilities of industrialization in the field of telecommunications equipment; approval of the study report on APSAT [expansion unknown] needs, to be pursued in cooperation with all African and international organizations interested in the project in order to set up a data bank; and the establishment of a working capital fund totaling 100 million CFA francs in order to correct treasury difficulties that now paralyze the general secretariat on occasion.

The Council also voted to send official thanks to Togo for the smooth operation of the Union during its mandate.

The new president of the Union is Lt Col Francois Dossou, minister of transport and communications of the People's Republic of Benin. The seventh ministerial session of the APTU will be held next year in Cotonou, Benin.

The Council also expressed President Eyadema, his government and his courageous people "for the warm and fraternal welcome they extended to all delegations visiting Togo."

It should be noted that the countries belonging to the APTU are Benin, the Congo, the Ivory Coast, the Central African Republic, Djibouti, the Comoro Islands, Upper Volta, Mauritania, Mali, Nigeria, Rwanda, Senegal, Chad and Togo.

11,464
CSO: 5500/5059

INCREASE IN COMPUTER SERVICE EXPECTED

Victoria NATION in English 4 Aug 81 p 1

[Article by Rene Morel]

[Text]

A NEW parastatal company may come into existence soon to take Seychelles into the field of modern computer technology.

The Computer Services Division of the Finance Department, created a few months ago, is already installing, operating and maintaining computer services in government ministries and national companies. It is expected that by next year it will be run as an independent company offering an expanded service to private concerns as well.

The Principal Secretary for Finance, Mr. Guy Morel, has described the Computer Services Division, located at Oceangate House, as very important, because it is able to give quick service at little cost for such business work as accounting, store-keeping, preparation of bills and salaries — jobs that would normally take accountants many hours.

"One computor does in seconds what an experienced accountant would do in several days; the computer cost for doing the work is very little compared to the accountant's salary; computers never get tired, and do not claim overtime. They reduce man-hours to fractions", Mr. Morel said.

The Computer Services Division has its own Seychellois staff, some of whom will soon be leaving in turns for overseas training. They are at present installing and programming some of the latest computer models available for business purposes.

Mr. Morel said computer service means a costly set-up — one computer alone costs R. 800,000. Therefore he regards the creation of a centralised computer services system as an important back-up service to assist not only the Government and national organisations, but also private businesses such as banks wishing to use computers.

The Government Treasury and the Seychelles Commodity Company Limited are the two biggest clients of Computer Services so far.

CSO: 5500/5063

TWO-DIMENSIONAL GRADIENT ADAPTIVE ALGORITHM FOR SIGNAL PROCESSING

Milan ALTA FREQUENZA in English May-Jun 81 pp 131-136

[Article by Giuseppe Martinelli, Mario Salerno, Istituto di Comunicazioni Elettriche, Facolta di Ingegneria, Roma, Renato Lucarelli, Fondazione Ugo Bordoni, Roma, Gianni Orlandi, Istituto di Comunicazioni Elettriche, Facolta di Ingegneria, Roma Dipartimento di Elettronica e Automatica, Facolta di Ingegneria, Ancona, and Mario Turchi, Sielte, Roma: "A New Two-Dimensional Gradient Adaptive Algorithm for Signal Processing"]

[Text]

Abstract. The optimal adjusting step in the gradient algorithms may be automatically acquired by applying a suitable algorithm, recently proposed by the authors for the one-dimensional case. The extension to the two-dimensional case is considered in the present paper with application to high-speed data transmission modem. The results obtained proves the effectiveness and flexibility of the proposed algorithm in signal processing.

1. INTRODUCTION

The convenience of gradient algorithms for adaptive signal processing relies on the simplicity of the resulting hardware. A clear example in this direction in the field of the one-dimensional data transmission equalizers is the celebrated model proposed by Lucky [1]. However, a very important drawback connected with the correct use of these algorithms is the problem of acquiring optimal adjustment. The present authors recently proposed an algorithm for overcoming the said inconvenience. This algorithm gives the possibility of automatically determining the optimal adjusting step [2,3].

The effectiveness of the algorithm has been ascertained: 1) in the case of one-dimensional data communication systems by simulation tests [4,5]. These tests regarded the effect of fixed-point arithmetic; 2) in the case of echo-cancellers for long-distance telephone connections, where adaptive filters with several hundred coefficients are necessary. The results of simulation tests in presence and absence of double talking are available in [6].

In the present paper we describe the extension of the algorithm to two-dimensional data communication systems, which is required when a high speed application is considered. The description of the extended algorithm is discussed in sect.3

and its use in the realization of a complex equalizer in a data transmission modem is considered in sect.4. Contributions pertinent to the topic dealt with in the paper are available in [7÷11].

2. REVIEW [2,3]

Let the sampled baseband received signal be

$$x_n = x(nT) = \sum_m a_m h(nT-mT) + v(nT) \qquad n=0,\pm1,\pm2,\ldots \tag{1}$$

where a_m is the information symbol (assumed to be coincident with a binary pseudo-random sequence of values ±1); $h(t)$ is the overall system impulse response; $v(t)$ is the additive channel noise; $1/T$ is the symbol as well as the sampling rate.
The output of the tranversal equalizer is

$$y_n = y(nT) = \underline{c}'\underline{x}_n \tag{2}$$

where the prime denotes transpose; $\underline{c}$ is the vector of the tap weights and $\underline{x}_n$ that of the received samples, i.e..

$$\underline{c}' = |c_N, c_{N-1}, \ldots\ldots, c_0, \ldots\ldots, c_{-N+1}, c_{-N}|$$

$$\underline{x}_n' = |x_{n-N}, x_{n-N+1}, \ldots\ldots, x_n, \ldots\ldots, x_{n+N-1}, x_{n+N}| \tag{3}$$

Under the assumption that the error sequences (y_k-a_k) are independent random variables, the mean square (m.s.e.) is given by

$$\xi(\underline{c}) = \underline{c}'A\underline{c} - 2\underline{c}'\underline{v} + 1 \tag{4}$$

where: $\underline{v}' = |h_{-N}, h_{-N+1}, \ldots\ldots, h_0, \ldots\ldots, h_{N-1}, h_N|$ denotes the vector of the 2N+1 center-channel samples, and the term a_{ij} of the matrix A is equal to

$$a_{ij} = \sum_m h_{m-i}\, h_{m-j} + \sigma^2 \delta_{ij} \tag{5}$$

with σ^2 being the noise variance at the equalizer input and δ_{ij} being Kronecher's delta.
The tap weights are adjusted in the gradient algorithm according to the recursion

$$\underline{c}^{(k+1)} = \underline{c}^{(k)} - \underline{r}^{(k)}\Delta_k \tag{6}$$

where

$$\underline{r}^{(k)} = A\underline{c}^{(k)} - \underline{v} \tag{7}$$

is the gradient in correspondence to the k-th step. The optimal adjusting step is equal to

$$\Delta_k = \frac{\underline{r}^{(k)\prime}\,\underline{r}^{(k)}}{\underline{r}^{(k)\prime} A\, \underline{r}^{(k)}} \tag{8}$$

In [3] we proved, under the assumption of $\{x_i\}$ to be independent random variables, that

$$(\underline{r})_i = \langle (y_n - a_n) x_{n-i} \rangle$$
$$(A\underline{r})_i = \langle \eta_n x_{n-i} \rangle \quad ; \quad \eta_n = \underline{r}'\underline{x}_n \tag{9}$$

where: $\langle\cdot\rangle$ denotes the expectation operation; the subscript i represents the i-th component of the corresponding vector. The scheme of the one-dimensional equalizer which corresponds to the above algorithm is shown in fig.1. It operates iteratively. Any step includes two sub-steps:

1) in the first one the switch is in the upper position and $\underline{r} = \underline{z}$ after $N_c T$ seconds (N_c is the number of samples required for averaging [3]);
2) in the second substep the switch is in the lower position and $\underline{s} = \underline{z}$ after $N_c T$ seconds. At the end of this substep the values of the taps are updated as shown in fig.1b.

From fig.1 we see that the proposed equalizer contains a double number of multipliers with respect to traditional equalizers [1].

3. TWO-DIMENSIONAL ALGORITHM

The extension of the gradient algorithm with inherent optimal adjusting step to the two-dimensional case is easily accomplished, if we use a complex description of all the quantities involved in the corresponding signal processing. Consequently, the quantities a_m, x_n, $\underline{c}$, $\underline{x}_n$, y_n, $h(nT)$, $v(nT)$ appearing in equ.s (1),(2),(3) are complex. We will denote their real and imaginary parts with the subscripts 1 and 2 respectively.
The m.s.e. in the present case becomes

$$\xi(\underline{c}) = \underline{c}'^{*}A\underline{c} - 2\mathrm{Re}\,|\underline{c}'\underline{v}'| + 1 \tag{10}$$

where * stands for complex conjugate; the term a_{ij} of A is given by

$$a_{ij} = \sum_m h^*_{(m-i)}\, h_{m-j} + (\sigma_1^2 + \sigma_2^2)\delta_{ij} \tag{11}$$

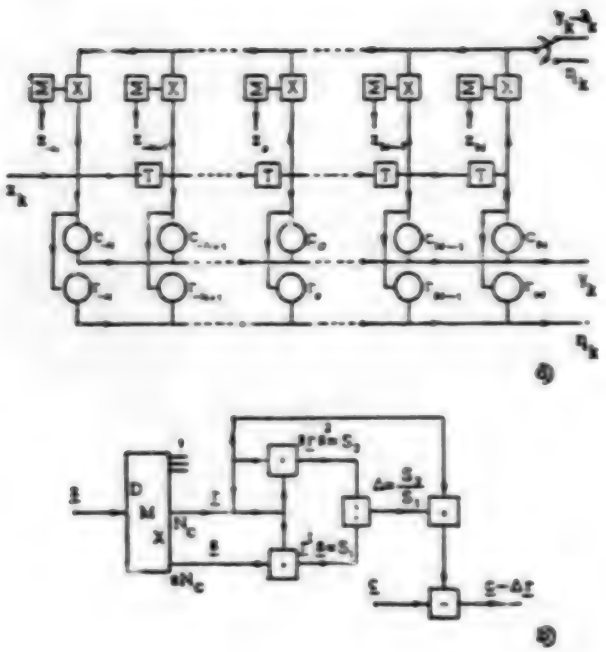
which proves that A is a hermitian positive definite matrix; $\mathrm{Re}\,|\ldots|$ stands for the real part of ...
The tap weights are adjusted by the recursion (6) where

$$\underline{r}^{(k)} = A\underline{c}^{(k)} - \underline{v}^* \tag{12}$$

and the optimal adjusting step is

$$\Delta_k = \frac{\underline{r}^{(k)\prime *}\,\underline{r}^{(k)}}{\underline{r}^{(k)\prime *} A\, \underline{r}^{(k)}} \tag{13}$$

From (13) we see that Δ_k is a real quantity in spite of the fact that the gradient is a complex vector. The quantity Δ_k may be approximatively calculated as in the one-dimensional case by formulas similar to (7). Namely, we may easily



Multiplication by a constant factor

Averagers (N_c samples)

Vector difference

Inner product or multiplication of a vector by a factor

Signal multiplication

Time delay (T sec)

Division

Demultiplexer with $2N_c$ taps (transmission time of T sec)

Fig.1 - Diagram of the adaptive equalizer with inherent optimal adjusting step. Part b shows in detail the process for updating the values of the taps.

prove, by following a procedure similar to that used in [3], that

$$(\underline{r}^*)_i \ll (y_n - e_n)^* \underline{x}_{n-i} \gg$$

$$(\Delta \underline{r}^*)_i \ll \eta_n^* \underline{x}_{n-i} \gg \quad ; \quad \eta_n = \underline{r}' \underline{x}_n \tag{14}$$

The resulting scheme of the complex equalizer with inherent adjusting step may be represented as in fig.1 with the following modifications:

1) all the quantities are complex, except S_1, S_2 and Δ;
2) the quantities $y_k - e_k$ and η_k must be complex conjugated before entering the switch;
3) the vector $\underline{r}$ is given by the complex conjugate of $\underline{z}$ in the first substep of operation;
4) the quantity S_1 should be real; consequently, we can obtain it as $\mathrm{Re}|\underline{r}'\underline{s}|$, taking account that an imaginary part could be present due to the approximate nature of the estimates.

4. APPLICATION OF THE TWO-DIMENSIONAL ALGORITHM TO A HIGHSPEED DATA COMMUNICATION SYSTEM

The two-dimensional algorithm described in the previous section has been used for implementing the equalizer in a high-speed data transmission modem. The complete data transmission system has been simulated; its scheme is depicted in fig.2. The blocks appearing in this figure are in the order:

1) Coder

The 9600 binary data are grouped into words of 4 bits. Each word of 4 bits is then mapped into one of the 16 two-tuples (a_1, a_2) (constellation). The output sequences $\{a_1\}$ and $\{a_2\}$ have a rate of 2400 bauds.

2) Shaping filters F_i

They are 10 percent roll-off raised-cosine filters with cutoff frequency equal to 1200 Hz, implemented by a transversal structure having 121 taps. The rate of the input sequences is 1400 samples/s, obtained by inserting 5 zero samples between two adjacent symbols of the sequences $\{a_1\}$ and $\{a_2\}$.

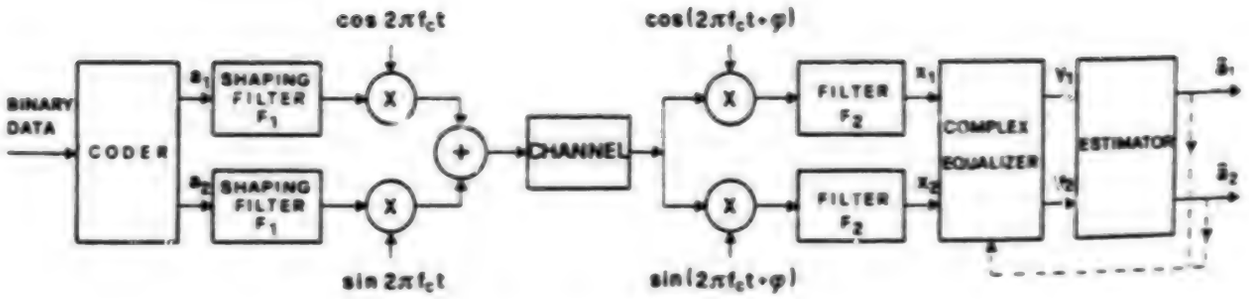


Fig.2 - Scheme of the data transmission system.

Fig.3-Impulse response of the telephone channel.

3) Modulator

The sequences (a_1) and (a_2) amplitude modulates, respectively, an in-phase and quadrature carrier with f_c=1700 Hz to generate the transmitted signal.

4) Channel

The impulse response of the channel is shown in fig.3. This response has been obtained by the FFT algorithm applied to the amplitude and delay characteristics of a typical telephone channel [12]. The channel has been simulated by a transversal structure with 121 taps operating at a rate of 14400 samples/s.

5) Demodulator

A suitable value of the phase φ is necessary in order to recover the correct alignment of the received constellation. In the present case, we have chosen φ=30.°.

6) Filters F2

They are chosen with the same characteristics of the shaping filters F_1. The rate of the output sequences is 2400 bauds, obtained by retaining one sample every 6.

7) Complex equalizer

The detailed scheme of this block is described in sect.3.

8) Estimator

The estimated couple $(\hat{a}_1, \hat{a}_2)$ is the point of the constellation closest to the received couple (y1, y2).

4.1 Simulations

The transmission through the previous system with an equalizer of 31 complex taps is simulated by considering as the input binary sequence a 2^{15}-1 CCITT pseudo-random sequence. During the training, performed with the "cyclic equalization" technique [13], the transmitted two-tuples of the constellation are (3,3), (-3,-3), originated by a 2^6-1 CCITT pseudo-random sequence. The constellation corresponds to a combined amplitude and phase modulation (AM-PM) [14].

The number of samples used for computing the averages in the equalizer is equal to the number of its taps, i.e. N=31, during the training and to 128 during the adaptive mode. The starting values of the taps are chosen to be all equal to zero with the exception of the central tap set to 1.

The test has been performed by passing 3180 bits corresponding to 10 iterations of training and 10 iterations of adaptive mode. The performances of the proposed algorithm is quite satisfactory, as it results from the behaviour of the m.s.e. shown in fig.4. This property is confirmed by the pictorial representation of the received couples in correspondence to the first iteration of the training and to the last iteration of the

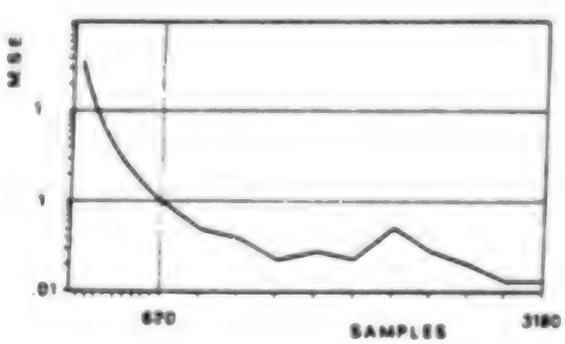


Fig.4 - r.m.s.e. versus the number of samples.

adaptive mode, shown in fig.5 and 6. It is interesting to note that in the first iteration of the training (fig.5) there are present several errors, corresponding to the received couples represented by the small circles depicted in the figure. In the last iteration of the adaptive mode there are not errors and the received couples are represented by points contained in very small areas around the constellation points. Finally, fig.7 shown the typical variation of the adjusting step automatically operated by the algorithm.

Further tests have proved the effectiveness of the equalizer also in presence of noise. The results of these tests are summarized in fig.8 and 9, where the signal-to-noise ratio is defined as the ratio between the mean powers of the signal and the Gaussian noise at the output of the channel (fig.2). We see from fig.8 that the convergence speed is slightly affected by the noise,as it results in the one-dimensionale case. The final m.s.e., instead, is affected by the noise, decreasing its value with S/N (fig.9).

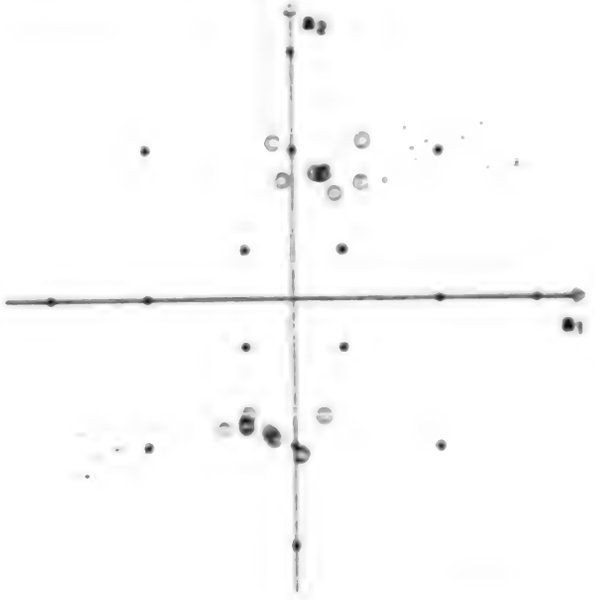


Fig.5 - Received couples in correspondence to the first iteration of the training. The small circles represent the couples which give error in the estimator. The stars represent the transmitted constellation.

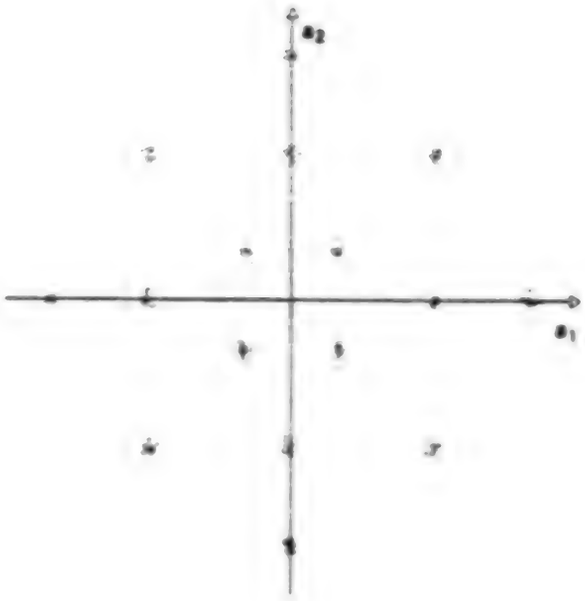


Fig.6 - Received couples in correspondence to the last iteration of the adaptive mode. There are no errors in this case and the received points are very close to the constellation.

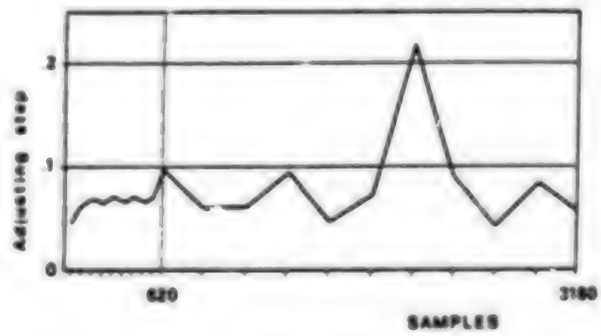


Fig.7 - Adjusting step versus the number of samples.

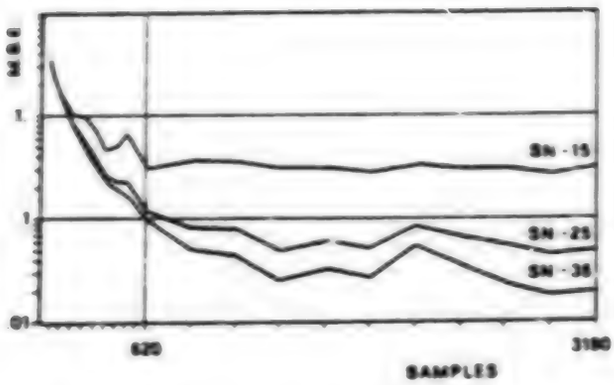


Fig.8 - m.s.e. versus the number of samples in presence of noise. The quantity S/N is the ratio between the mean powers of the signal and the noise at the output of the channel expressed in dB.

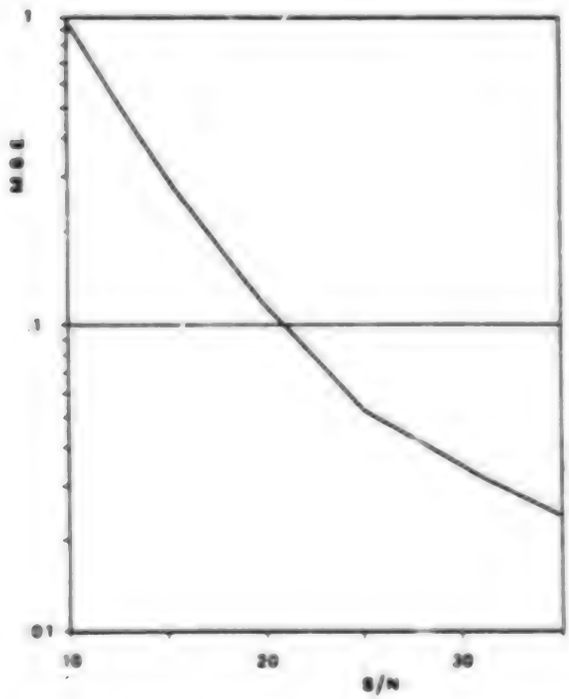


Fig.9 - m.s.e. versus the signal-to-noise ratio S/N. The value of the m.s.e. is calculated by averaging the m.s.e. corresponding to the last four iterations in the adaptive mode.

5. CONCLUSIONS

The effectiveness of the gradient algorithm with inherent optimal adjusting step in the case of two-dimensional data communication system has been pointed out in the paper. The resulting complex equalizer has a structure which is suitable for microprocessor implementation. Further work, presently in progress, concerns with its real-time realization by a mixed architecture including bit-slice components and hardware multipliers.

This work was performed at the Fondazione Ugo Bordoni, according to an agreement between Fondazione Ugo Bordoni and the Istituto Superiore delle Poste e Telecomunicazioni.

Manuscript received on November 17, 1980.

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CSO: 5500/2291

IMPLEMENTATION OF MULTISTANDARD TELETEXT SIGNAL GENERATOR

Milan ALTA FREQUENZA in English Jul-Aug 81 pp 231-237

[Article by Renzo de Paoli, Istituto Elettrotecnico Nazionale "Galileo Ferraris", Corso M. D'Azeglio 42, 10125 Torino, Ricardo Daffara, Alfredo Rinaudo, Centro di Studio Per La Televisione del C. N. R., I. E. N. G. F., Corso M. D'Azeglio 42, Torino, and Franco Mussino, Istituto di Elettrotecnica e Telecomunicazioni, Politecnico di Torino, Corso Duca Degli Abruzzi 24, 10129 Torino: "A Multistandard Teletext Signal Generator"]

[Text]

Abstract. This paper describes the implementation of a versatile teletext signal generator whose most significant feature is its software and hardware programmability: this allows the generation of a teletext signal according to different standards, for example CEEFAX/ORACLE or ANTIOPE.

1. INTRODUCTION

The Teletext is a very important and interesting service that many television broadcasting companies are planning to offer to their subscribers in the next years.

This service is able to satisfy a number of information needs, offering to the viewers written messages or simple drawings.

The Teletext signal uses the unoccupied part of the television waveform (the field-blanking interval) for the transmission of a number of binary-coded characters, at a given bit rate. Since the unoccupied space in the television waveform is limited, also the number of written pages that can be transmitted sequentially in a given time is limited. For example, using only two television lines, it is possible to transmit a set of one hundred pages of 24 rows of 40 characters each. In this case, the acquisition of a new page in the receiver can be waited for a maximum of 24 s, after its selection.

In the last years a few Teletext systems have been developed in different Countries.

some of them are already in operation, as the British CEEFAX/ORACLE, others such as the French ANTIOPE and the Canadian TELIDON are nothing more than experimental.

In order to be able to carry out some experiments with different standards, a number of complex pieces of equipment are needed. Since the generators available on the market are able to operate only with a well defined standard, the design and the implementation of a multi-standard signal generator was carried out.

To get such a versatility, the generator was divided in two parts: the control unit and the transmitter unit.

The control unit has been designed using a microprocessor which provides both editing and storage of data to be transmitted; this unit also codifies the digital information according to a specific standard.

The transmitter unit has been designed using normal analog and digital circuitry and provides the synchronization of the above digital information with the television line frequency and also the insertion of the digital signals on the video waveform, during the field blanking interval.

The control unit was implemented with a modular approach, in such a way that the memory can be expanded up to store and then to transmit a complete set of pages (up to a maximum of one hundred); this unit also provides interfaces with a terminal (keyboard), external memory (such as disk, tape, etc.), other intelligent units and the transmitter unit.

The operation of the control unit can be modified through the software; until now, complete programs have been developed for the British CEEFAX/ORACLE Teletext system and for the French ANTIOPE. The transmitter unit was also designed to be widely programmable. This allows the selection of the bit-rate of the data transmission and of other characteristic parameters according to the chosen Teletext system.

Therefore this generator is really versatile and when suitable software has been developed, a large number of possible Teletext standards can be generated and transmitted with the same equipment.

2 THE CONTROL UNIT

The control unit has the main task of generating and continuously updating the digital information to be sent to the transmitter unit.

A microprocessor can accomplish this task; therefore this unit has been designed using such a device. Its operation is done under software control.

At the time of the design (1977), one of the most suitable device was the Fairchild F8 microprocessor, which had the important feature to be sufficiently fast and widely available on the market from several manufacturers. Obviously other microprocessors of suitable characteristics can be used.

Nevertheless, the first experimental transmission has been made using the PDP 11/45 general purpose computer, fully available at the CNR TV-Center, where the Teletext generator has been designed and assembled.

The use of a microprocessor instead of a minicomputer has the main advantage that the Teletext generator can be completely independent from the external apparatus and easily transportable where the measurements or tests are to be made.

2.1 Hardware description

The design of the control unit has been done taking into account the possible expansions of the memory and of the interfaces; therefore a modular approach has been adopted. Eight different cards, of Eurocard format (100x160 mm), were implemented; they are:

- the central processing card (CPU card) implemented around the F8 family of integrated circuits;
- three kinds of memory cards, with selectable addresses, that is: 4 Kbyte of EPROM, 4 Kbyte of static RAM and 16 Kbyte of dynamic RAM;
- the serial 20 mA current-loop interface, teletype compatible;
- the serial EIA standard RS 232 C interface;
- the general purpose Input/Output interface;
- the PDP 11/DP 11A parallel interface.

Among these circuits the most important is the parallel I/O interface, between the two units of the Teletext generator. The main characteristics of it are summarized in Table I; the diagram of fig. 1 indicates the data and control signals in this interface.

The data transfer through this interface is controlled by two "Transfer Request"

TABLE I

Main characteristics of the parallel interface between the two units of the Teletext generator

- Number of Data Output lines (Data latched on card)	8
- Number of Data Input lines (Data to be latched on peripheric)	8
- Lines available for Control Word (Output)	3
- Lines available for "Transfer Request" (active high) (Inputs)	2
- Data output strobe (positive pulse)	1
- Data input strobe (positive pulse)	1
- Ground	2
- Number of available lines	25

lines which can generate, under program control, an interrupt sequence in the microprocessor system. These "Transfer Request" lines are cleared by the microprocessor during the servicing routines, with the hardware generation of a "New Data Ready" pulse during the execution of a data output instruction and a "Data Transmitted" pulse during the execution of a data input instruction.

The memory of the Teletext generator is organized as in the following:

- the 64 byte of the F8 scratchpad internal memory are used as pointers and current data store;
- the first 16 kbyte of memory locations are devoted to program store (on EPROM or static RAM, if external mass memory is used);
- the other 48 kbyte of memory locations, directly addressable with the F8 microprocessor, are used as data store.

Really two banks of 48 kbyte of memory locations (on dynamic RAM) are available for data store. The bank selection bit is provided by an I/O port of the F8 microprocessor.

Each one of the two data memory banks can support 51 pages of UK Teletext information, containing 960 characters each.

2.2 Software description

The monitor program of the multistandard Teletext signal generator controls and supervises all the operations of the microprocessor.

Firstly, the program provides the control of the flow of the data from the memory to the interface circuits of the transmitter unit.

Secondly, the program controls the operation of the various peripheral interfaces; so it is possible to perform input or output operations using a serial peripheric (such as a full-ASCII encoded keyboard), or a minicomputer, or the front-panel console (containing switches and a LED display).

The software has been organized in such a way that it is possible to send commands to the monitor or edit text-pages to be transmitted, using each one of the alphanumeric peripheral.

The program consists of a start-up procedure, two main loops (namely: TELETEXT LOOP and MONITOR LOOP), and some accessory subroutines (fig. 2).

At power-on or when a reset is performed, the monitor program executes specific hardware initializations and presets some transmission parameters with given constants, according to the selected Teletext standard (fig. 3).

The main loops perform only some test procedures under the input/output request and the possible calls to the subroutines serving these requests. The TELETEXT LOOP (or TLOOP) is synchronized by the TV field interval (20 ms) using the master request signal coming from the transmitter unit (fig. 1 and 4).

As soon as this signal becomes active, TLOOP calls the Teletext transmission routine (TXTRAN). At the end of it, the possible requests coming from other peripherals

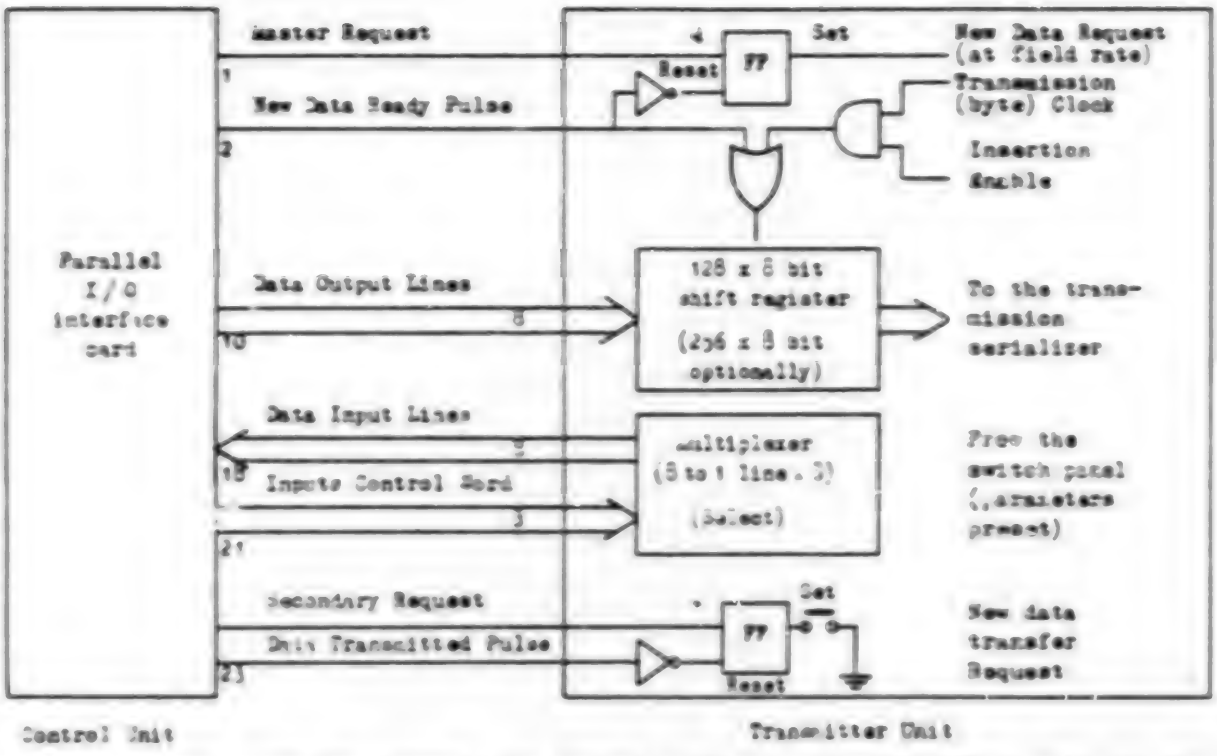

Fig. 1 - Hardware interface between the control unit and the transmitter unit of the multistandard Teletext signal generator.

are tested. If these requests are not present, the program execution starts again to wait for a transmitter master request.

The MONITOR LOOP (or MLOOP) is not involved with the Teletext signal transmission. When this program is running, the microprocessor does not control the signal encoder and can execute other operations, such as high speed input/output, on-line debugging of programs, minicomputer intercommunication, preset of Teletext parameters (fig. 5).

The operator can call each one of the loops from the others by means of specific commands coming from any peripheral. The commands are decoded by special purpose subroutines (TXTDEC and MCMDEC), which call the correspondent executory subroutines.

The minicomputer intercommunication subroutine allows the storage of all the text-pages to be transmitted also in the mass memory of a minicomputer or development system. This subroutine is also useful in editing text off-line and to develop new user routines by means of the utility programs of a large operating system.

Other auxiliary subroutines perform the following operations:

- to update the time information (the software clock counts the signal encoder requests coming at 50 Hz rate);
- to generate an odd-parity code for the Teletext characters;
- to perform high speed serial input/output operations;
- to execute characters echo on the output peripherals;
- to allow on-line debugging of programs (by means of the full-ASCII keyboards as data input and the front-panel console with a LED display as data output);
- to set the header control bits of the selected page and select the transmission standard (CEEFAX/ORACLE or ANTIOPE) decoding the switches on the front-panel console;
- to allow the setting of the date and of the clock on all the pages headers (CEEFAX/ORACLE standard only);
- to continuously transmit a selected page in order to compose or correct it (in this case a blinking mark is displayed on the TV screen to point at the text insertion place);

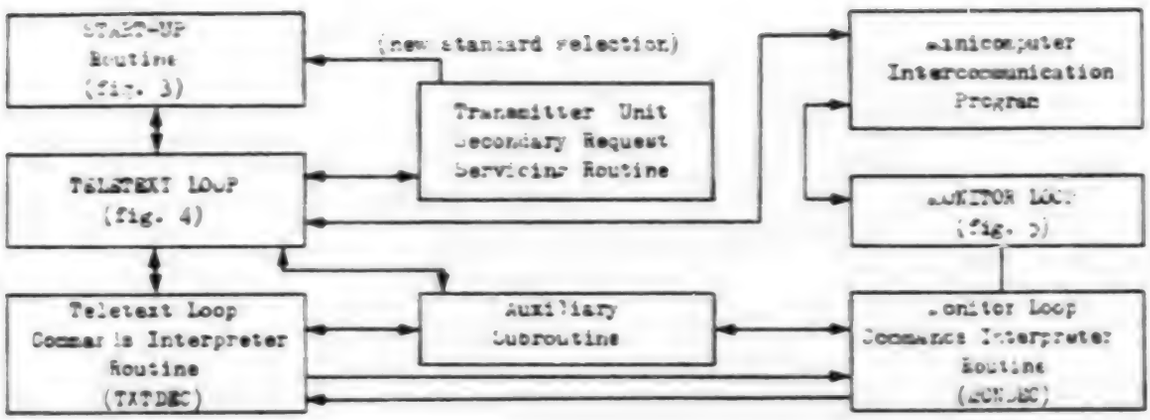

Fig. 2 - General flow chart of the Control Unit's Program.

- to allow the movements of the blinking mark in any direction and to insert or delete characters in the written text;
- to restart the normal sequential transmission of all the text pages.

3. THE TRANSMITTER UNIT

The main tasks the transmitter unit has primarily to accomplish are:

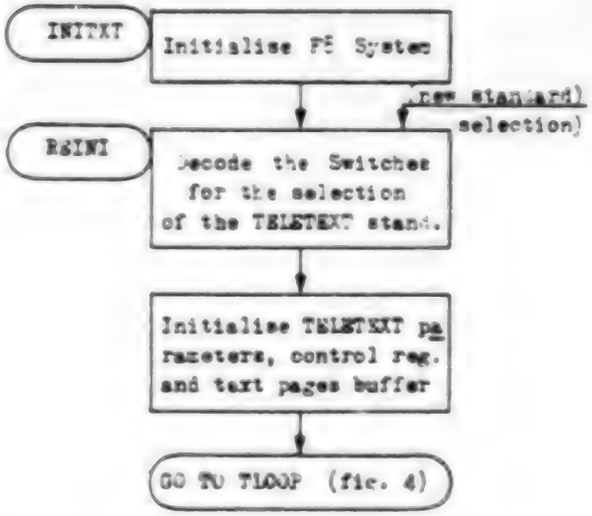

Fig. 3 - Flow-chart of the START-UP Routine.

- to convert the parallel data string, coming from the control unit, into a serial sequence of bits;
- to derive from the incoming television signal the synchronizing pulses in order to be able to allocate the digital signal into the television waveform.

As an option, this unit should generate a black and white bar-signal, that can replace the external television signal.

The block diagram of fig. 6 shows in detail the various parts of the transmitter unit.

The incoming television signal is first dc-restored, to set the black level at a fixed voltage, making more easy the mixing with the digital signal. The external television signal can be replaced with that generated inside. An identification circuit is able to recognize the presence of the external TV signal and in case of its absence the internal bar-signal generator is automatically switched on.

The incoming television signal is also sent to a sync-separator, which derives the line and field synchronizing pulses, and are used to synchronize the local sync-generator, freely running when no external TV signal is applied to the Teletext generator.

The clock generator circuit has three different quartz-controlled oscillators that can be, one at a time, locked to the TV line frequency to generate the appropriate bit rate of the Teletext signal; moreover, an external input is available when an asynchronous bit rate is required.

The parallel-to-serial digital signal converter, which is the most important part of the transmitter unit, has the task of converting the parallel data, coming from the input/output interface of the control unit, in a serial sequence of bits. The converter works under the control of the insertion window generator, which allocates the serial information in a specific number of lines

of the field blanking interval of the television waveform: there is the provision on the front-panel of suitable switches (fig. 6) that allow the selection from one to twelve of the number of TV lines occupied by the digital signal and to allocate them in any position in the TV field blanking interval.

The parallel-to-serial conversion is operated by means of eight 128-bit serial-in/serial-out shift registers that store the digital information coming from the control unit, during a large part of the field period. The content of these registers is then transmitted at high speed using an 8-bit parallel-in/serial-out shift register, that generates the string of bits, at the wanted bit-rate. The digital signal is mixed with the video waveform via a shaping filter, that reduces the bandwidth of the digital signal to about 5 MHz.

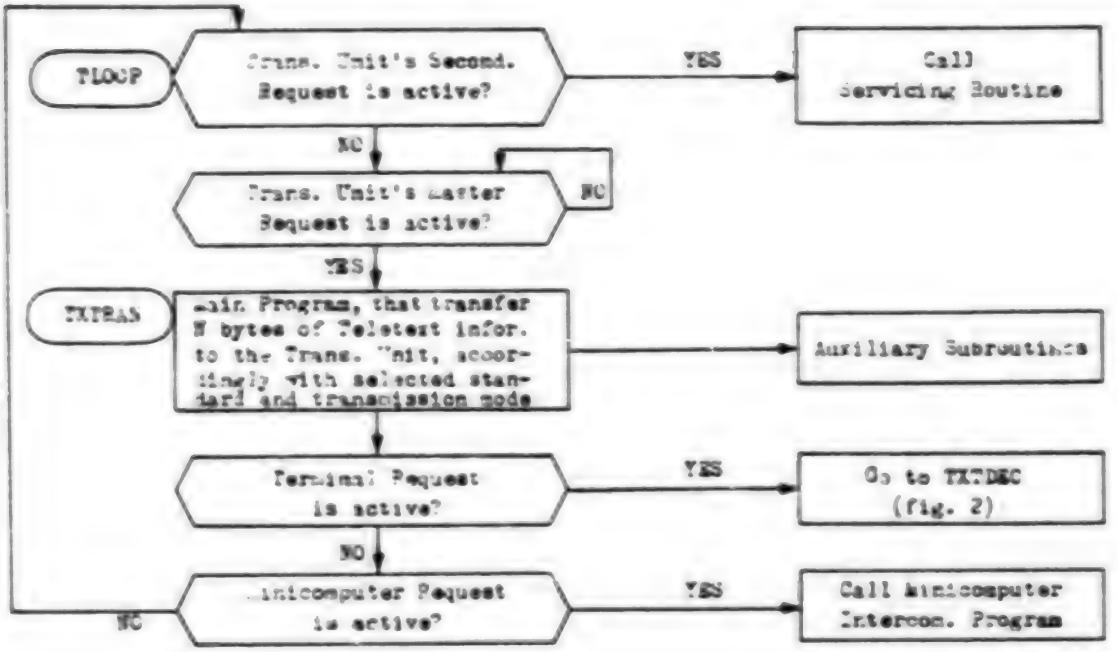

Fig. 4 - Flow-chart of TELETEXT LOOP Program.

4. CONCLUSIONS

The Teletext signal generator here described has been designed specially for testing purposes: the development of its various parts has been done taking into account the possible needs of different Teletext standards. This versatility has been reached using a microprocessor in the control unit and allowing the selection of the number of the TV lines occupied by the digital signal and their position in the TV field blanking interval.

Up to now, this generator is able to transmit a Teletext signal according to two standards, the British CEEFAX/ORACLE and the French ANTIOPE.

Examples of pages transmitted according to these two standards are shown in fig. 7 and 8. The external aspect of the multistandard Teletext signal generator is shown in fig. 9.

Acknowledgement

The authors are very grateful to Prof. C. Egidi, Director of the Centro di Studio per la Televisione del C.N.R., for the encouragement and support during the work and to Ing. A. Farina and P. Belisomi of the Indesit S.p.A., for the valuable contribution in defining the characteristics of this generator.

- The development of this multistandard Teletext generator has been undertaken with the support of INDESIT S.p.A., None (Torino), Italy, a manufacturer of television receivers.

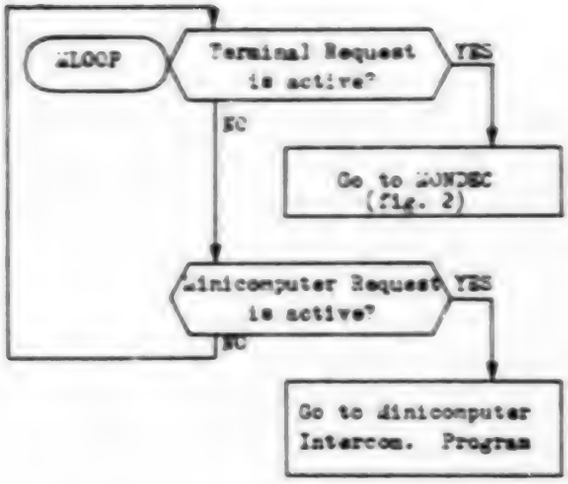

Fig. 5 - Flow-chart of MONITOR LOOP Program.

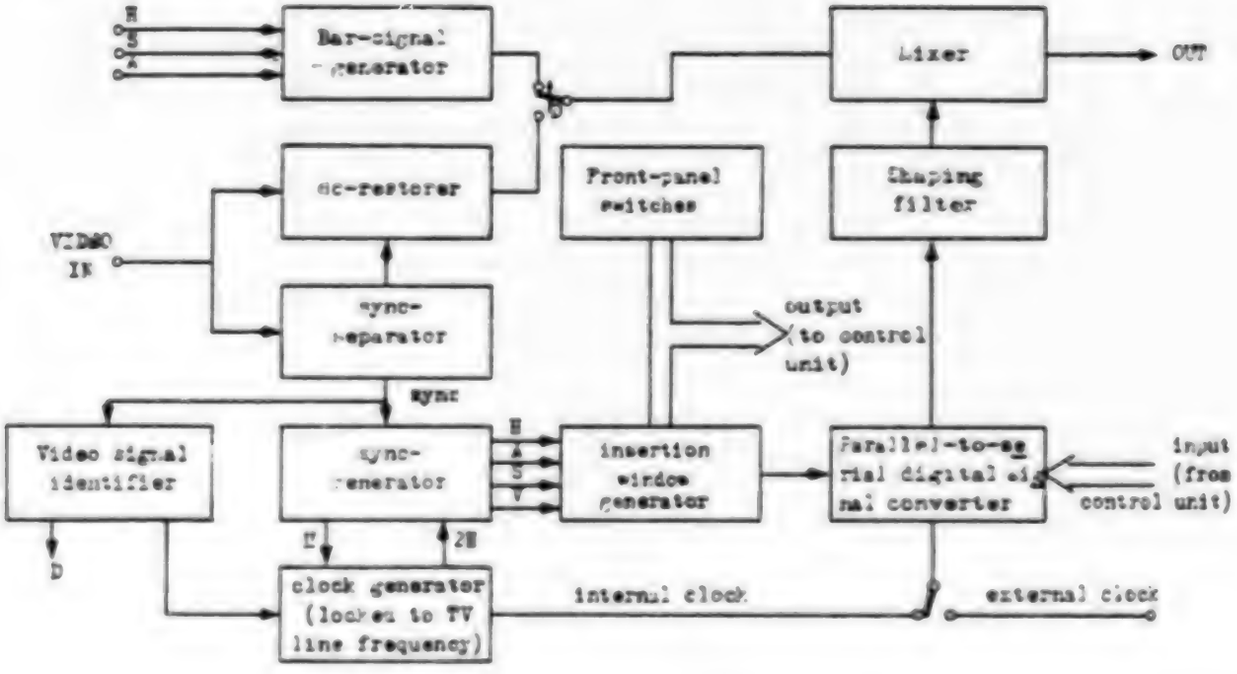

Fig. 6 - Block diagram of the transmitter unit. A: horizontal blanking; S: sync-pulses, D: deviator
D: deviator (electrically operated); H: line pulse driver; V: vertical pulse driver.

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Manuscript received on September 30, 1980

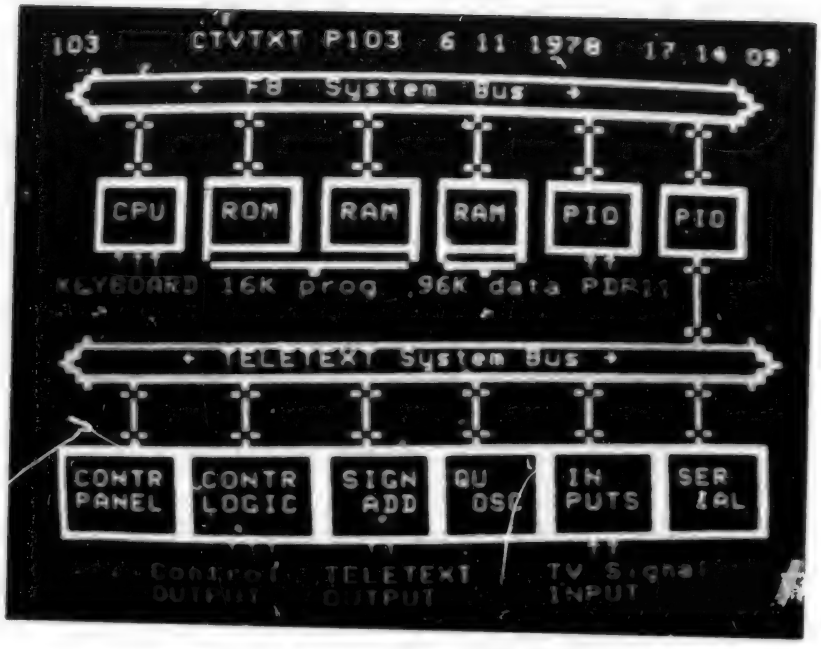

Fig. 7 - Example of a Teletext page transmitted according to the British CEEFAX/ORACLE standard.

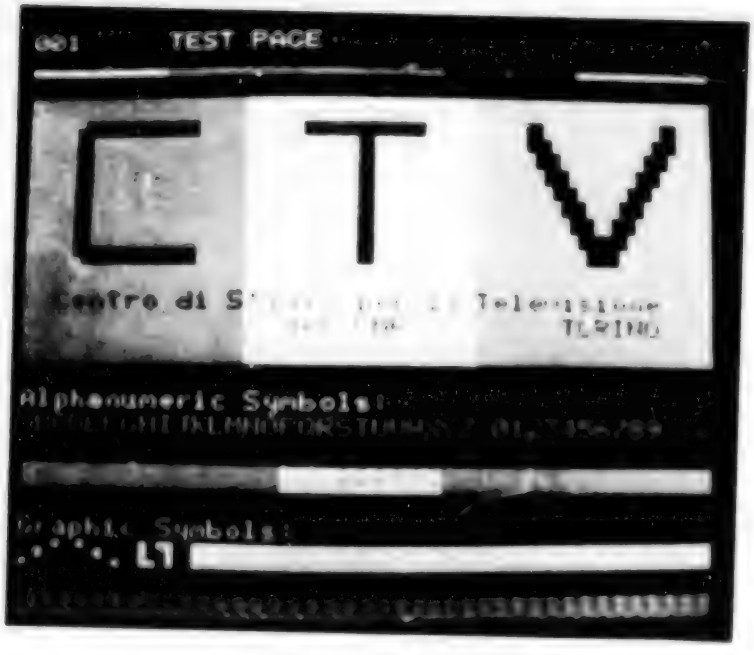

Fig. 8 - Example of a Teletext page transmitted according to the French ANTIOPE standard.

Fig. 9 - The external aspect of the multi-standard Teletext signal generator.

CSO: 5500/2289

NEW IONOGRAM STORAGE-AND-DISPLAY SYSTEM DESCRIBED

Milan ALTA FREQUENZA in English Jul-Aug 81 pp 219-222

[Article by Antonio Guiducci, Istituto Elettrotecnico Nazionale "Galileo Ferraris", Corso Massimo D'Azeglio 42, 10125 Torino: "A New Type of Ionogram Storage-and-Display-System Using a CCIR 625 Lines/Frame TV Monitor"]

[Text]

Abstract.A new system for the memorization, processing and visualization of ionograms, that makes use of a CCIR 625 lines/frame TV monitor is described. An increased flexibility in the analysis of ionospheric data is achieved. In particular, the completely automatic scaling of the ionospheric characteristics is made possible.

1.- INTRODUCTION

The analysis and the interpretation of the ionospheric phenomena are based upon the collection of data that are gathered through several different approaches: radars, missiles, satellites, riometers and so on. Among them is the ionosonde: an apparatus which has extensively contributed to understand the dynamics of the upper atmosphere, especially because of its distribution over the entire globe and of its handiness, which permit a complete observation of the ionosphere both geographically and temporally.

The ionosonde is a radar operating on a variable frequency (often between 1 and 16 MHz) which beams vertically overhead its radiowaves and detects the delay time of the echoes returned from the successive ionospheric layers. The output of the ionosonde is a plot giving the virtual height of reflection versus frequency, namely the ionogram. Several characteristic parameters, as the minimum heights and the critical frequencies of the different layers, together with the MUF-(3000) (Maximum Usable Frequency over a distance of 3000 km) and Fmin (lowest frequency at which echo traces are observed), can be extracted from one ionogram and ordered in tables [1]. This way, a large quantity of data become available to the laboratories and scientists all over the world.

At the IEN (Istituto Elettrotecnico Nazionale) in Turin a digital ionosonde by the trade name of "Digisonde 128" has been operating since 1976. Its digital output is stored on magnetic tapes. The present paper describes a new system for the memorization and visualization of the ionograms, designed and developed at the IEN, and now in operation for the semiautomatic reading of the ionospheric parameters.

2.- THE SYSTEM OUTLINE

The visualization of an image (an ionogram in this case), stored in the memory of a minicomputer, over a TV monitor requires a matching between the rate with which the minicomputer can supply the stored data and the refreshing rate of the monitor itself. For this reason a standard 625 lines/frame TV monitor cannot be refreshed directly by a minicomputer which is by itself too slow. At the IEN, a superseded system used a 200 lines/frame videotelephone monitor which was directly refreshable by the computer, through a DMA interface, because of its low horizontal deflection rate [2,3]. This system was definitely unsatisfactory since not only utilizing a monitor outside the CCIR standards, hence almost unreplaceable in case of failure, but also implying an exceedingly large occupation of the central memory for the storage of the ionogram, which on the other hand, was needed for the planned complete automation of the ionogram's processing. Therefore, a device capable of memorizing a complete ionogram, namely a matrix of 256x128 points of 8 bits each, and at the same time, of displaying it on a standard 625 lines/frame TV monitor was designed and developed.

The block diagram of fig. 1 helps the understanding of this set up in its details. The minicomputer DIGITAL PDP 11/15 can accept, via the DR11-C interface, sequences of data corresponding to the columns (i.e. frequencies) of the ionogram's matrix, supplied either by one of the two magnetic tape recorders - 2 and 3 in fig. 1 - or, in real time, directly by the ionosonde 1, and memorize them, via the DMA interface (DR11-B) and the Control Unit 5, into the External Memory 6. The content of the External Memory is continuously visualized on the standard TV monitor. Furthermore, the Control Unit can display and move over the entire screen of the monitor, under commands coming from the computer, a flashing pointer and a so called "transmiss.or curve", which are used for extracting the ionospheric characteristics respectively

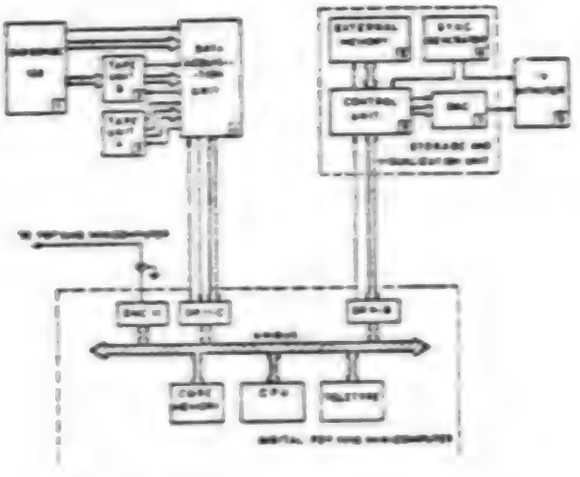

Fig. 1 Block diagram of the system.

as the coordinates of the pointer (heights and frequencies) and the position of the curve (MUF). These readings are memorized into a magnetic disk unit carried by the DIGITAL PDP 11/45 minicomputer of the neighboring "Centro di Studio per la Televisione del CNR" which is linked to the DIGITAL PDP 11/15 via two DMC 11 interfaces. Moreover, the PDP 11/45 can use the External Memory through that link as one of its peripherals. This way the elaboration programs can be first developed and tested on the more powerful "45" and then utilized on the "15".

3.- THE STORAGE AND VISUALIZATION UNIT

The image (ionogram) that must be visualized on the monitor (fig. 3) is a matrix of 256x128 points of 8 bits each. In order to obtain the most efficient occupation of the monitor's screen, each elementary area of the image has been chosen to be a square two-line high (i.e. equal fields) and 166.6 ns wide (6 MHz clock). The remaining portion of the screen has been left available for the visualization of the alphanumeric characters which are needed for displaying the information pertinent to each ionogram like the date, hour and so on, and concerning the actual position of the pointer and the other readings. The ionogram memory was subdivided into 4 subunits operating in parallel to avoid the need of using memory chips of too high ratings. Hence, the cycle time required during the visualization is 666.6 ns. It can be achieved quite easily by means of the commercially available LSI circuits.

The details of this interface are described with reference to fig. 2. During normal operation (continuous refreshing) the memory is available to the computer in the interval of time between successive video refreshings, i.e. during 11.8 us

out of the 20 ms of the field scansion. By the way, the visualization can be interrupted and the connection of the memory to the computer maintained, if necessary. During the 11.8 ms, the computer can read or modify the memory content by loading the I/O Address Counter [4] of fig. 2 - with the starting address of the string of data to be transferred by DMA, and utilizing the Control and Status Register of the DR11-B in order to communicate to the Control Unit [1] the desired operations: reading or writing, by rows or by columns. Under the action of the Control Unit the bytes of information are transferred by DMA between the computer memory and the external memory [5-8]. During the 8.2 ms of the TV Monitor refreshing the Control Unit interrupts every DMA cycle eventually in progress and puts on the Address Bus the content of the Refresh Address Counter [3]. The remaining DMA cycles are performed after the visualization of the 128th row. The end of the transfer is reported to the Control Unit by the READY signal from the DR11-B.

3.1 - Memory I/O and TV Refresh

Every write operation of the memory consists of the memorization of a 32-bit word. This word is built up in the I/O Buffers [9,10] latching two sequential 16-bit words supplied by the DR11-B and is stored into the external memory subunits Ma through Md, as follows.
First word (word A): low byte in Ma, high byte in Mc;
Second word (word B): low byte in Mb, high byte in Md.

In a similar way, following a memory read operation, a 32-bit word is available on the memory output terminals. The two 16-bit words A and B to be sequentially fed into the DR11-B for their transmission to the computer memory, are obtained at the output of the I/O Buffers, latching first the content of Ma and Mc and then the content of Mb and Md. Hence, it follows that a write or read cycle is performed every two DMA cycles. For this same reason, the content of the I/O Address Counter, that is the address on the Address Bus, must be incremented only every two DMA cycles.

The TV Monitor refreshing is similar to the output operation described above, except that the address on the Address Bus is supplied by the Refresh Address Counter [3] and that the words A and B are further serialized by the Output Multiplexer [15]. As a result, for each address on the Address Bus, 4 bytes of 8 bits each are sequentially fed to the DA Converter [16] and displayed as 4 subsequent ionogram points on the TV Monitor [17].

3.2 - Pointer and Transmission Curve

As stated in Section 2, a flashing pointer and a curve (transmission curve), movable over the entire screen, are needed for the semiautomatic reading of the ionospheric data. This task is accomplished without modifying the content of the external memory as follows. To display and move the pointer, the computer loads the pointer address into the Pointer Position Latch [11]. When this address and the address on the Address Bus are equal the number on the output of the Console Switch Decoder [18] is fed into the DAC [16], instead of the actual ionogram point value. This number alternates between 0 and a value N with a frequency F. N and F are selected by the Console Switches [19].

On the other hand, the 127 column addresses of the transmission curve are stored in place of the last column of the ionogram that, during the visualization of the curve itself, is not displayed. In other words, the 256th byte of each row, istead of being displayed, is stored into the Curve Point Position Latch [13] and represents the address of the point of the curve for the following row. The curve grey level is again selected by the Console Switches.

3.3 - Character Generator

Together with the ionogram, the alphanumeric information is visualized on the TV Monitor, which then can be used as the output terminal of the computer as well.

The PDP 11/15 transmits the position and the ASCII code of each character to be visualized, to the interface that stores such an information in the Character Memory [21]. The 36 strings of 52 character each, contained in such a memory, are automatically visualized over the screens zones free from the ionogram.

4.- CONCLUSION

The apparatus described in the preceeding Sections is actually in operation at the ionospheric station of the IEN. It proved to be quite useful not only for the semiautomatic reading of the ionospheric characteristics, but also for allowing several elaborations of these data. Such elaborations are performed in order to eliminate disturbances and interferences from radio stations which hinder the correct interpretation of the ionograms, especially in the automatic approach. The results obtained with this apparatus - see figs. 4 and 5 - are rather promising [4]

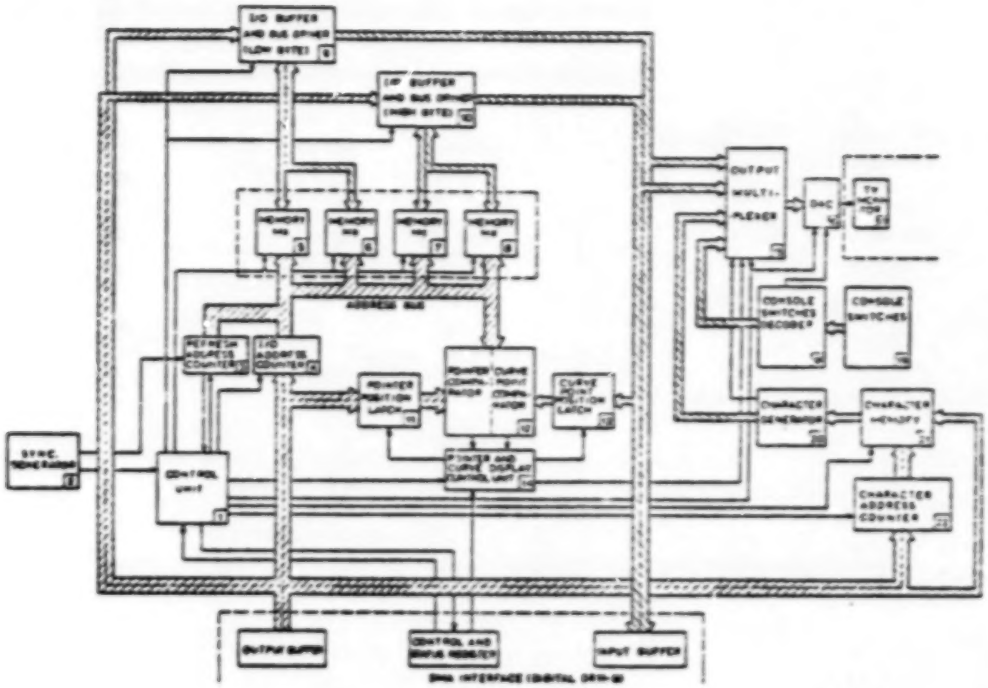

Fig. 2 - Block diagram of the storage and visualization unit.

and will lead, in the near future, to the completely automatic reading of the inospheric characteristics. This goal, which is in the auspices of all the operators who are monotonously and tediously dealing with the cumbersome collection of ionograms, will be a most welcome achievement. Indeed, once the routine of manual analysis will turn out to be obsolete the still hidden information contained in the ionograms rejected by the computer on account of their anomalous complexity will come to full evidence and will ask for further studies.

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Fig. 3 - Picture of the TV monitor screen showing a typical ionogram and alphanumeric information display.

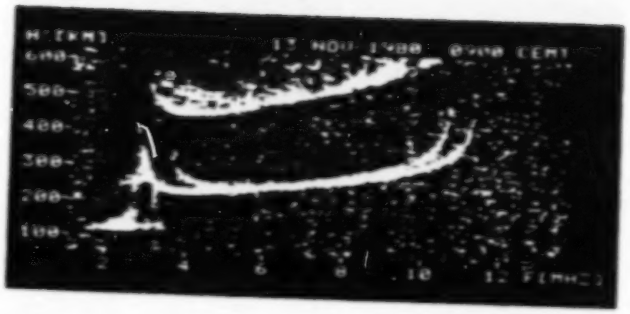

Fig. 4 - Digital processing on the ionogram of fig. 3 showing the suppression of the interference from radio stations.

Fig. 5 - Skeletonization of the ionogram of fig. 3 by using a digital convolution filter.

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